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U.S. DEPARTMENT OF AGRICULTURE - FOREST SERVICE
CALIFORNIA FOREST AND RANGE EXPERIMENT STATION
Division of Forest Insect Research

FOREST INSECT AERIAL SURVEY
CALIFORNIA REGION
Spring, 1958

Introduction

The 1958 aerial survey of forest insect conditions in California was flown during the period of April 21 to May 9. The flight personnel consisted of the following: Pilot, Grant Ruth from the Forest Service Regional Office; observers: R.C. Hall, G.C. Trostle and B.E. Wickman from the California Forest and Range Experiment Station plus other Forest Service, Park Service and State Division of Forestry personnel as listed in the tables. A Forest Service Cessna 180 was the aircraft used throughout the survey (figure 1). Total airtime of the survey was 56 hours and 30 minutes of which 38 hours and 30 minutes were spent actually examining forested areas and 18 hours were for ferry time between national forests.

Objectives

The main objective of this year's survey differed slightly from those of previous years. Before, the annual aerial survey was used primarily for the discovery of any infestations which had not been reported by the ground detection system.1/ This year the primary objective of the spring aerial survey was to inspect areas where ground detection reports indicated problems, and to examine other problem areas such as recent burns and blowdown.2/ Generally, the aerial survey is planned to cover as much of the timbered area of California as time and financing will allow. In addition, the Station entomologists test new equipment and techniques during the flights in an effort to improve aerial survey methods.

Survey Technique

Some changes were made in the spring survey to improve our aerial program. Ground-checking of areas spotted from the air has often lagged

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1/ Forest Insect Aerial Survey, California Region, Fall 1954. G.L. Downing.

2/ Work plan for the 1958 Spring Aerial Survey, April 17, 1958, by R.C. Hall.

Figure 1.--Forest Service Cessna 180 used for the Spring 1958 aerial survey of California region. (Left to right - Grant Ruth, F.S. pilot and Bill Jones, U.S.F.S.)

Figure 2.--Group of young ponderosa pine killed by western pine beetle in 1958. Buckhorn Ridge, Siskiyou County, California.

several months after the flight. This year the entomologist who flew an area ground-checked serious infestations which were accessible. Most areas were ground-checked the week following aerial observation. For the last several years, Dan Dotta of the State Division of Forestry has assisted in the survey as one of the observers. This year various local Forest Service, Park Service, and State Division of Forestry personnel from the management staff assisted in this capacity because of their knowledge of local conditions. Dotta assisted with the ground-checks. Field foresters were notified by letter of the survey schedule.

Special equipment used on the flights, some for trial or further testing, included five pairs of sunglasses which the Pacific Northwest Experiment Station reported to be most useful for insect aerial surveys. And Trostle tested the tape recorder again this year using a new type of recording tape which is hard to break. Other equipment included: a Fairchild K-20 aerial camera with panchromatic film and a red filter (figure 2); Forest Service National Forest and District maps, scale of $\frac{1}{2}$ inch to the mile; aluminum map boards; a flight summary form to fill out the end of each day (attachment); and football helmets to use as crash helmets in a forced landing.

Prior to a flight, a short briefing took place on the ground. Areas to be examined were pointed out on the map and the local man given instructions on what to look for while in the air. Also, the Berkeley office was contacted by telephone and the flight plan for the day filed.

The entomologist used the right front seat of the plane and gave the pilot flight directions. The pilot helped a great deal with navigation and sometimes with observations. The second observer used the left rear seat. The air speed during most observations was 100 m.p.h., and the altitude was 1,000 - 1,500 feet over the forest canopy. No predetermined flight lines were used. Areas of known or suspected infestations were flown, with the entomological observer tracking his flight line from one infestation area to another in colored pencil on a map. Observations were continued during the flight between known infested areas. This type of survey caused meandering flight lines, but covered the forest fairly well. High elevation stands were avoided as much as possible because of the difficulty of observing through snow glare. Whenever recent insect loss was seen, the number and species of trees was noted in the proper location on the flight map. The maps were used for ground-checking and saved for future reference.

Operation and Findings

The usefulness of various special items of equipment tried this year was ascertained during survey operations. The sunglasses, although not used extensively, were a special aid. By concensus of opinion, the yellow lens proved to be the most helpful for conditions of poor lighting. For glare protection on bright days there was much

difference in personal preference as to the type and color of lens. The following tabulation summarizes observers' first impressions of the glasses.

Brand and color of lens	Remarks
Cosmetan (smoky amber)	Good haze penetration, some color distortion.
Noviall (light yellow)	Very good for partly cloudy conditions.
B & L Kalichrome C (yellow)	Very good for partly cloudy conditions.
B & L Rayban (green)	Good glare protection.
B & L Rayban G-15 (neutral gray)	Good glare protection, no distortion of color. Poor haze penetration.

Further trials with sunglasses should be made in subsequent surveys.

Another equipment item that was of considerable help was the tape recorder. This was of special value in taking records of conditions where losses were heavy. Although it was not used by all observers, it would be a distinct advantage to do so in future surveys.

In this year's operations it was again found that the maps available are not wholly suited to survey needs. They lack the detail required for accurate navigation; consequently, improved maps are still very desirable. The operations also revealed that an addition should be made to the flight summary form to provide for tachometer reading entries at takeoffs and landings.

The following table summarizes the daily operation of the aerial survey and tells briefly what was found from the air. Reports on the results of ground-checks have been or are being made and sent to the land owner or land managing agency when completed.

Date	Flight Personnel	Flown from	Area Flown	Survey Time	Ferry Time	Observations
4/21	Wickman, Hall, Averell	S.F.	To Fresno		1:30	None
4/21	R. Werner, USFS Wickman (Grant Ruth was pilot for all flights)	Fresno	Hume Lake Dist. & McGee Burn, Sequoia NF.	1:00	:20	Ips and D.b. in P.p.: group of 40, Cherry flat; 30, Sampson flat; 20, Mill Flat Creek; 20, E. of Pine ridge; Heavy, scattered loss N. & E. of Delilah lookout; Moderate scattered loss N.E. of Pine ridge, E. of McKenzie ridge; scattered singles E. of McGee Rch.,1 mi. E. of McKenzie G.S., Millwood, S.E. of Happy Gap, Eshom Cr. Camp, Pierce Valley, W. of Converse Mt., town of Miramonte.
4/21	Bectel, NPS Wickman	Fresno	W. ½ Sequoia Natl. Park	1:00	:20	One large S.P. with D.m. near General Grant tree, several scattered P.p. with D.b. in Cedar Grove. Very light loss in Sugar Loaf Valley, clouds obscured rest of flight observations.
4/22	Hall, R.C.	Fresno	S.½ Inyo NF	:30	:20	Heavy concentrated loss south of Monache Meadows on north and east slope of Deer Mt. Most of the infested trees appear to be abandoned. Needs ground-checking, prob. Jeffrey Pine.
4/22	Hall, R.C.	Fresno	Cannell Meadows Sequoia NF.	:30	:17	Scattered heavy loss in Jeffrey pine. Red and white fir. Some of this loss may be old.
4/22	Hall, R.C. Pierce, J.R. USFS	Bakersfield	Mt. Pinos Dist. Los Padres NF	:25	:10	Some concentrated loss in Cuddy Valley. Mt. Pinos, and Frazier Mt. scattered loss. Scattered moderate loss on the west and central portion of Alamo Mt.

Date	Flight Personnel	Flown from	Area Flown	Survey Time	Ferry Time	Observations
4/22	Hall, R.C. Pierce, J.R. USFS	Bakersfield	Big Pines, Wrightwood Angeles-San Bernardino NF	:15		Very light loss in area treated by sanitation-salvage. Concentrated loss in pole-sized timber in the town of Wrightwood.
4/22	Hall, R.C. Pierce, J.R. USFS	Bakersfield	N½ Arrowhead, Big Bear area San Bernardino NF	:15		Some scattered loss in north fringe of the Arrowhead-Big Bear area and south of Big Bear Lake. Also what appeared to be heavy loss in Pinyon Pine east of Big Bear Lake.
4/22	Hall, R.C. Pierce, J.R. USFS	Bakersfield	Joshua Tree National Monument	:15		Concentrated loss in Pinyon Pine in Juniper Flats area and to west for about 2 miles. No fresh fades. Needs ground-checking.
4/22	Hall, R.C. Pierce, J.R.	Bakersfield	Santa Rosa Mt. San Bernardino NF	:15		Heavy current loss in what appears to be Jeffrey pine and white fir. Heaviest loss on the eastern and northern slope of the mountain. Needs ground-checking. Also some Pinyon loss.
4/22	Hall, R.C. Pierce, J.R. USFS	Bakersfield	Lost Valley Cleveland NF	:10		Heavy current loss in Jeffrey pine in Lost Valley - Needs ground-checking.
4/22	Hall, R.C. Pierce, J.R. USFS	Bakersfield	Julian and Pine Hills	:10		Heavy group concentrations of Coulter and Jeffrey pine. Very little evidence of current fade.
4/22	Hall, R.C. Pierce, J.R.	Bakersfield	Cuyamaca State Park	:10	:06	Practically no current loss observed. Area looks very clean.

Date	Flight Personnel	Flown from	Area Flown	Survey Time	Ferry Time	Observations
4/22	Hall, R.C. McBride, R.S., USFS	El Cajon	Laguna Mt. Pine Valley Cleveland NF.	:20	:10	Area looks suprisingly good after the winter control program.
4/23	Hall, R.C. Pierce, J.R.	El Cajon	Palomar Mt. Cleveland NF.	:20	:10	Very light current loss.
4/23	Hall, R.C. Pierce, J.R.	El Cajon	San Jacinto Dist. San Bernardino NF.	:25		Very heavy loss in Bunker Ranch very S. end of Garner Valley. Rest of Garner Valley relatively clean. Fairly heavy concentration in May Valley. Rest of district looks relatively clean except for extreme north edge of timber toward Banning.
4/23	Hall, R.C. Pierce, J.R.	El Cajon	Raywood Flat San Bernardino NF.	:20	:10	Scattered bark beetle loss and evidence of thin foliage possibly some defoliator. Considerable snow on the ground which made spotting difficult. This area needs checking.
4/23	Pierce, J.R. Blanford, R. CDF	Riverside	Arrowhead-Big Bear Dist. San Bernardino NF.	:20	:05	Arrowhead area looked relatively clean with Big Bear Lake showing evidence of fairly heavy scattered loss.
4/23	Pierce, J.R. Blanford, R.	Riverside	Barton Flat area San Bernardino NF.	:20	:08	Barton Flat sanitation-salvage area looke very clean but some scattered loss in area adjacent.
4/23	Averell, J.L.	Riverside	To S.F.		3:30	None
4/24	Trostle, Wickman Averell, USFS	Concord	Mendocino to Klamath	1:30	:30	A few scattered P.p fades in eastern foothills of Mendocino NF.

Date	Flight Personnel	Flown from	Area Flown	Survey Time	Ferry Time	Observations
4/24	Trostle,Wickman	Cave Junction	Klamath NF. Haystack Burn	2:00		Horse and Middle Creeks, Buckhorn ridge have scattered groups of 4-10 P.p. Upper Kohl Creek, numerous groups P.p. Not connected with fire.
4/24	Trostle, Bill Gerson,USFS Bill Howard,USFS	Montague	Klamath NF.	2:00		2 groups of P.p. on flat at lower end of Kidder Creek fire and one off FS land at lower end of Clarks Creek below Etna. Bogus Burn may be infested. Showed numerous red trees but may be burn.
4/25	Trostle,Wickman	Montague to Redding			:42	None.
4/25	Trostle, Ray Dourghty, USFS	Redding	W.½ Shasta Trinity NF.	2:06		A little scattered P.p. loss, just south of the highway on lower slope of Thomas Pk.
4/26	Trostle	Redding Eureka	To Eureka from Redding and return		1:24	None.
4/26	Trostle, Corson Williams	Eureka	Six Rivers NF.	2:30		Very light loss.
4/28	Bosworth,USFS Wickman	Quincy	Plumas NF.	2:30	:10	Light loss w.½ of forest. Snow in high country. Defoliated fir in Howland flat. Scattered loss in Little Last Chance. Several small groups of J.p. on end of Wild Cat Ridge, west of Thompson Peak. Scattered J.p. loss throughout Middle Creek drainage (1 group of 6). Group of 10 P.p. with Ips and D.b. 2 mi. north of Greenville between RR tracks and highway.

Date	Flight Personnel	Flown from	Area Flown	Survey Time	Ferry Time	Observations
4/29	Smith, USFS Wickman	Alturas	Modoc NF.	2:30	:20	Many dead, small P.p. North of Moll Reserv. caused by poisoning (TSI work) and Ips. Heavy P.p. blowdown southeast of Round Mt. Group of 5 P.p. w/D.b. south end of Big Canyon R8E.T41N. Continued heavy loss of L.p. by D.m. in Skunk Cabbage Creek. Group of 60 young P.p. with Ips on upper Juniper Creek R14E.T40N.
4/30	Scott & Friday, USFS Wickman	Mt. Shasta	E.½ Shasta NF.	1:45	:05	Scattered P.p. and S.p. loss east of Harris Mt., south of Powder Hill and on the Hearst Estate. Water damage to young P.p. on Huckleberry Creek.
4/30	Mitchell, USFS Wickman	Susanville	Lassen NF.	2:30	:05	Heavy scattered loss of small P.p. caused by D.b. and Ips north of upper Brockman Flat - result of Merrill Burn. Large groups of young P.p. in Sec. 33, 34, 28, 29, 20, 21, 22, 16, 17, 8, 5. R4E.T34N., probably Ips. Group of 10 P.p. north of Burney Springs. Young white fir discolored in Eiler Gulch. Scattered P.p. and S.p. loss south of Wilcox Butte. 6 large P.p. with D.b. 2 mi. north of Hat Creek rim L.O. at rd. junction.
4/30	Wickman	Redding to S.F.			1:30	None
5/5/58	Trestle John Mahoney, NPS.	Mariposa	Yosemite NP. Inyo NF.	2:00	1:12	Scattered P.p. in area of Bishop Creek 1½ miles on either side of the road. Also in Bishop Creek drainage south of Henness Ridge L.O. High elevations were snow covered. Snow in higher elevations of Inyo NF., but a large number of faded J.p. were seen.

Date	Flight Personnel	Flown from	Area Flown	Survey Time	Ferry Time	Observations
5/5	Trostle, Bill Paldi, USFS	Fresno	Sierra	2:18	:24	Black Rock - Fence Mdws. some scattered P.p. loss. Two areas adjacent to power-line south of Mathews mill in Jose basin, young P.p. were gray but held most of the needles. Should check. Old group of P.p. base of Thornberry Mt. An area of scattered loss between Paterson Mill and Sugar Pine. Sweetwater - Jerseydale area has the most noticeable P.p. losses.
5/6	Trostle, Snow Fowler, USFS	Columbia	Stanislaus	2:36	:42	One group of mostly old P.p. on ridge north of Walker Meadows. Several old groups spotted last fall N.E. of Duckwall Mt. One group typical of these losses was seen south of Confidence on Hwy. 108 where power line crosses. Infestation is on powerline right of way. Some old P.p. loss seen on northwest shore Lyons Resrv. Fire in P.p. with possible bugs at Hunter Res., Avery. Some old P.p. loss on east edge of meadow west of Groveland R.S. Jawbone shows several old groups on saddle crossed by road to camp 45. Several new fades showing west of Jawbone Station.
5/7	Trostle, Jerry Hill, USFS	Placerville	Eldorado NF.	1:30	:30	Area south of Big X Mountain had about 5 groups, P.p. and S.p., of 20 trees or so, mostly old. Pino Grande area has new fades showing in the area which has been infested for the past three years.

Date	Flight Personnel	Flown from	Area Flown	Survey Time	Ferry Time	Observations
5/7	Trostle, Hal Turner, USFS	Grass Valley	Tahoe NF.	1:48	1:00	One group of 7 S.p. on Cedar Ridge near Grass Valley, next to a house.
5/9	Hall, R.C.	Concord	To Willows		:51	None
5/9	Hall, R.C. Jones, W.V., USFS	Willows	Stonyford Dist. Mendocino NF.	:50	:05	Scattered single and group loss district-wide. Most of the loss appears to be late summer '57 with much lighter over-wintering loss. Principally confined to ponderosa and sugar pine, heaviest on south slopes.
5/9	Hall, R.C. Jones, W.V.	Willows	Paskenta Mendocino NF.	:45	:15	Same general picture as on the Stony-ford District. Both these areas need to be ground-checked, particularly the area around Ball Rock Lookout.
5/9	Hall, R.C.	Willows	Lake County	:20	:16	Area around Clear Lake looks very good. Practically no loss observed in ponderosa pine.
5/9	Hall, R.C. Snow, G., CDF.	Santa Rosa	Cobb Mt. Resort area	:27	:06	Cobb Mt. recreation area was very clean. Light scattered loss in ponderosa pine around Cobb, but most of this loss was late summer 1957. Large concentration of Knobcone pine loss south of Mt. Hannah This is not the same group reported last year. Should be ground-checked.
5/9	Hall, R.C.	Santa Rosa	To S.F.		:45	None

Discussion and Recommendations

The survey covered a large area of timberland in a comparatively short time, and all of the major known infestations were examined. Some of the local men knew conditions and locations in their areas very well and were a help as observers. Little time was lost in ferry time picking up local people because the total number of cooperators was kept low; only a few central airports were used, there was no duplication of flying over areas of mixed ownership, and the entomologist observed and mapped when he was flying between forests to pick up the next man.

There were shortcomings to the system also. Because so little time was allotted to the survey the forests were not flown on predetermined flightlines 6 miles apart. Therefore, there were undoubtedly some unreported infestations which the survey missed. One example was three large groups of ponderosa pine which were found on the Hat Creek district by chance. Also, though most of the cooperators knew local conditions, some had a tendency to ignore infestations on property which occurred outside of their jurisdiction making observation doubly difficult for the entomologist. Others understandably were watching for several things on their lands as they spotted for bug trees. This reduces the accuracy of a survey, but is not necessarily a fault of the cooperators. Aerial observers for insect surveys require many hours of training and experience plus a good knowledge of forest trees and insects. Most field foresters have not been trained for this specialized function. Consequently, the entomological observer was often doing the job of two men.

The system of prompt ground-checking accessible areas worked out very well. Snow prevented some ground-checking in the higher elevations. These areas will be examined later in the season. Prompt field examination gave the observer a chance to check the accuracy of his interpretation from the air and there was no chance for the insect conditions to change between time of aerial observation and field examination. This gave the local land manager a prompt appraisal of the situation even though the surveys are carried on too late in the year to plan immediate control action on serious bark beetle outbreaks.

To improve the efficiency of future surveys, the following suggestions are made:

1. The timbered areas of the State should be flown in a grid system to pick up unknown infestations.

2. The survey crew should function as a team. The pilot should have insect survey experience and have an interest in his job as Grant Ruth did. The observers should be forest entomologists or foresters with aerial observation training and experience.

3. Some system of crew operation like one man using the tape recorder, another responsible for photos, and both men mapping should be devised.

4. The crew should train in the air over an area with insect loss for at least one full day to sharpen their spotting ability and become familiar with flying again after a 6 to 12 month lay off.

5. More hours of aerial survey time should be allotted to the State.

The aerial survey achieved its objectives this spring, but to be efficient for larger surveys and to take some of the load off the single entomological observer, two well-trained forest entomologists should be used.

Berkeley, California
May 21, 1958

Boyd E. Wickman
Entomologist

APPENDIX

Suggested List of Airports[3/]

Area to be flown	City and airport
Modoc NF	Fall River Mills AP Alturas AP
Lassen Volcanic NP Lassen NF	Fall River Mills, AP Chester AP Susanville AP Redding, Benton Field
Plumas NF	Quincy AP Chester AP
Tahoe NF	Marysville AP Grass Valley AP
Eldorado NF	Placerville AP Jackson AP
Stanislaus NF	Columbia AP San Andreas AP
Sierra NF Yosemite NP	Fresno, Chandler Field Mariposa AP
Sequoia NF Sequoia NP	Fresno, Chandler Field Visalia AP Porterville AP
Inyo NF	Fresno, Chandler Field Bishop AP
Los Padres NF	Bakersfield AP Santa Barbara AP
Angeles NF	Ontario AP (avoid Burbank AP and Inglewood AP - smog and heavy air traffic)
San Bernardino NF	San Bernardino AP Riverside AP

3/ Amended airport list from Downing's Forest Insect Aerial Survey report, Fall 1954.

Area to be flown	City and airport
Cleveland NF	San Diego AP Ramona AP El Cajon AP
Mendocino NF	Willows AP Santa Rosa AP
Shasta-Trinity NF	Redding, Benton Field Fall River Mills AP
Klamath NF	Montague, Siskiyou County AP
Six Rivers NF	Eureka AP

The following airports have proven to be satisfactory as main bases of operation for each of the following areas:

Area	City and airport
Northern California	Redding, Benton Field
Central Sierra	Marysville AP
Southern Sierra	Fresno, Chandler Field
Southern California	San Bernardino AP

This is not a complete list of airports in the forest areas, but those listed have good landing strips and gas is usually available.

COSTS

*Salaries	$581.00
*Per diem	275.00
Total flying time	
56.5 hrs. at $20.00 per hour rental	$1,130.00
Telephone calls	25.00
**Total cost of survey	$2,011.00

*Includes salaries of participating personnel from the California Forest and Range Experiment Station only. Pilot's salary and per diem included in plane rental.
**Includes ground-checking.